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L-19-228

10 CFR 50.73

ATTN: Document Control Desk
United States Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject:
Davis-Besse Nuclear Power Station, Unit 1
Docket Number 50-346, License Number NPF-3
Licensee Event Report 2019-003

Enclosed is Licensee Event Report (LER) 2019-003, "Anticipatory Reactor Trip System Actuated Unexpectedly During Turbine Stop Valve Testing due to the Closure of a Main Turbine Stop Valve." This event is being reported pursuant to 10 CFR 50.73(a)(2)(iv)(A).

There are no regulatory commitments contained in this letter or its enclosure. The actions described represent intended or planned actions and are described for information only. If there are any questions or if additional information is required, please contact Mr. James M. Vetter, Manager – Site Regulatory Compliance (Acting), at (419) 321-7393.

Sincerely,

for M. B. Bezilla

Mark B. Bezilla

JCS

Enclosure: LER 2019-003

cc: NRC Region III Administrator
NRC Resident Inspector
NRR Project Manager
Utility Radiological Safety Board

IE22
NRR

NRC FORM 366 (04-2018) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 3/31/2020

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Information Services Branch (T-2 F43), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB- 10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of digits/characters for each block)

(See NUREG-1022, R.3 for instruction and guidance for completing this form http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1022/r3/

1. Facility Name	2. Docket Number	3. Page
Davis-Besse Nuclear Power Station, Unit 1	05000 346	1 OF 4

4. Title:

Anticipatory Reactor Trip System Actuated During Turbine Stop Valve Testing due to the Closure of a Main Turbine Stop Valve

5. Event Date			6. LER Number			7. Report Date			8. Other Facilities Involved	
Month	Day	Year	Year	Sequential Number	Rev No.	Month	Day	Year	Facility Name	Docket Number
09	07	2019	2019 -	003 -	00	11	06	2019		05000
									Facility Name	Docket Number 05000

9. Operating Mode	11. This Report is Submitted Pursuant to the Requirements of 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. Power Level	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
95	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ Other (Specify in Abstract below or in NRC Form 366A)	

12. Licensee Contact for this LER

Licensee Contact	Telephone Number (Include Area Code)
Joseph C. Sturdavant, Staff Nuclear Specialist – Regulatory Compliance	(419) 321-8199

13. Complete One Line for Each Component Failure Described in this Report

Cause	System	Component	Manufacturer	Reportable to ICES	Cause	System	Component	Manufacturer	Reportable to ICES
X	TA	ISV	GE	Y					

14. Supplemental Report Expected	15. Expected Submission Date	Month	Day	Year
☐ Yes (If yes, complete 15. Expected Submission Date) ☒ No				

Abstract (Limit to 1400 spaces, i.e., approximately 14 single-spaced typewritten lines)

On September 7, 2019, with the Davis-Besse Nuclear Power Station operating at approximately 95 percent power, during scheduled Main Turbine Stop Valve 2 (MSV) testing, Main Turbine Stop Valve 4 unexpectedly stroked closed and Anticipatory Reactor Trip System (ARTS) actuated, tripping the reactor.

The most likely cause of the MSV 4 closure was mechanical binding / sticking or foreign material in the internals of the valve operating system (fast acting solenoid valve) causing its inadvertent actuation.

Actions taken include replacing and testing the MSV 4 fast acting solenoid valve and testing ARTS. Scheduled actions include replacing similar components on the other MSVs, and cleaning the EHC fluid sump, replacing the EHC fluid and particulate strainers.

This issue is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A).

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Davis-Besse Nuclear Power Station Unit 1	05000 - 346	2019	- 003	- 00

NARRATIVE

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

DESCRIPTION OF OCCURRENCE:

System Description:

The Davis-Besse Nuclear Power Station (DBNPS) Main Generator [TB] converts rotating mechanical energy of the Main Turbine [TA] into electrical energy. Main Steam enters the High Pressure Main Turbine through four (4) individual Main Turbine Stop Valves [TA-ISV]. The primary function of the Main Turbine Stop Valves (MSV) is to quickly shutoff steam flow to the Turbine under emergency conditions. Each valve has its own hydraulic power actuator which uses Electro-Hydraulic Control (EHC) system hydraulic fluid pressure to open the valve and a compressed spring to close it when the hydraulic pressure is released. Each valve has a control pac which provides the hydraulic mechanism for positioning the valve disk, and to test the valve closing capability.

The purpose of the Anticipatory Reactor Trip System (ARTS) is to initiate a reactor trip on a loss of main feedwater [SI] event or a trip of the Main Turbine [TA] at power in order to reduce the magnitude of pressure and temperature transients on the Reactor Coolant System [AB]. This lowers the probability of the Pressurizer Pilot Operated Relief Valve (PORV) [AB-RV] actuation during these events. The ARTS is not credited to mitigate the consequence of any accident in the Updated Final Safety Analysis Report (UFSAR).

The ARTS consists of four separate redundant protection channels that receive inputs of Main Feedwater (MFW) pump [SI-P] status and Main Turbine status. Pressure switches are used to detect Turbine Generator (TG) trip by sensing the Main Turbine Stop Valve EHC hydraulic pressure, which is normally applied to the disc dump valve chamber of the Main Turbine Stop Valve. The hydraulic fluid is released to trip the valve. There is one pressure switch on each stop valve hydraulic line. There are four pressure switches, one for each of the four ARTS channels. Pressure switch contacts open upon TG trip. The ARTS monitors the following generating station variables: 1) Turbine-Generator status, 2) Main Feedpump Turbine status, 3) Steam and Feedwater Line Rupture Control System status. One group of pressure switches monitors the fast-acting solenoids for the turbine generator stop valves and will trip the reactor. Whenever any two ARTS channels transmit channel trip signals, the logic trip module in each channel actuates to remove power from its associated Control Rod Drive trip breaker [AA-BKR].

The EHC system controls the operation of the turbine stop, control and combined intermediate valves. The hydraulic power unit develops the hydraulic power required to operate the Main Turbine Stop Valves, Control Valves, and the Combined Intermediate Valves. Power to the valves is controlled by a series of hydraulic servovalves and solenoid operated pilot valves. The system pressure is maintained at approximately 1600 psi.

During normal operation, the Emergency Trip Supply (ETS) is pressurized from the EHC hydraulic fluid supply. Any trip action of the EHC system will ultimately remove the fluid pressure from ETS which will trip (close) the Main and Reheat Stop Valves, the Control and Intercept Valves. When the ETS is pressurized and the valve's fast-acting test solenoid is deenergized, full hydraulic pressure is admitted below the valve's disk dump valve to seal it in. The ETS pressure is also transmitted through an orifice to the pilot-end of the shutoff valve which will then stroke open and admit full Fluid Actuator Supply (FAS) pressure to the servovalve soon after the disk dump valve has been sealed in. The servovalve can then control the flow into and out of the hydraulic cylinder as commanded by its electric signal.

NARRATIVE

DESCRIPTION OF OCCURRENCE: (continued)

The EHC bulk fluid, contained in the 800 gallon fluid reservoir, is filtered and conditioned to minimize EHC fluid degradation. The EHC filter system maintains the fluid within acceptable vendor specifications and minimizes the corrosion potential in the system there in improving system reliability by extending the service life of the hydraulic components.

DESCRIPTION OF EVENT:

On September 7, 2019, the DBNPS was operating at approximately 95 percent power to perform scheduled Main Turbine Stop Valve (MSV) testing. Following successful valve testing of MSV 4 and 3; MSV 2 was tested. When MSV 2 was stroked closed, MSV 4 unexpectedly closed. Subsequently, the ARTS instrumentation associated with the EHC System sensed low Emergency Trip Supply (ETS) pressure and sent a trip signal to the reactor protection system tripping the reactor at 1309 hours. Based on a low ETS pressure condition this was the expected response of ARTS.

Initial unit response to the reactor trip was as designed, and all control rods fully inserted. Following the event, the operators took manual control of the Turbine Bypass Valves to reseat the Steam Generator Safety Valves [SG-RV] per procedure.

CAUSE OF EVENT:

The Direct Cause of the reactor trip was the loss of ETS header pressure within the MSV 4 control pac which caused inadvertent actuation of the MSV 4 internal Disk Dump Valve. This resulted in an unexpected fast closure of MSV 4, during the fast closure of MSV 2 as part of its normal testing sequence. This sequence of events caused the ETS fluid pressure as sensed by ARTS to drop below 275 psig, the ARTS pressure setpoint, initiating an ARTS trip on Loss of Turbine-Generator. With ARTS channel 2 in bypass for testing, the low ETS pressure at MSV 4 met the two out of four-coincidence logic, causing ARTS to open the four (4) CRD trip breakers.

The Apparent Cause of the inadvertent actuation of the internal Disk Dump Valve of MSV 4 was due to improper seating/positioning of MSV 4 Fast Acting Solenoid Valve (FASV) most likely caused by mechanical binding / sticking or foreign material excursion due to recent degradation of EHC fluid quality.

The Contributing Cause of recent degradation of EHC fluid quality was due to the purification of EHC fluid being interrupted from June 21 to August 6, 2019 because the EHC purification skid was out of service. While not exceeding the OEM limit, the fluid quality could have possibly contributed to preexisting fluid/internal pipe surface contamination and produced or released accumulated foreign material throughout the system.

ANALYSIS OF EVENT:

A Probabilistic Risk Assessment (PRA) evaluation was performed for the September 7, 2019 automatic scram. A conservative analysis of this uncomplicated plant scram results in a delta Core Damage Frequency (CDF)

NARRATIVE

ANALYSIS OF EVENT: (continued)

that is well below the acceptable threshold of 1x10-6/yr as discussed in Regulatory Guide 1.174. The risk of this event is therefore, considered very low safety significance in accordance with the Regulatory Guidance.

Reportability Discussion:

The automatic actuation of the Reactor Protection System (RPS) while the reactor is critical is reportable within four hours of occurrence per 10 CFR 50.72(b)(2)(iv)(B). On September 7, 2019, at 1553 hours this event was reported to the NRC Operations Center (Event Number 54263).

This issue is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A), which requires reporting of any event or condition that resulted in manual or automatic actuation of the RPS, including a reactor scram or reactor trip. All safety systems performed as required in response to the event, and no loss of safety function occurred.

CORRECTIVE ACTIONS:

Completed Actions:

The MSV 4 FASV was replaced during the September 2019 forced outage. Normal valve testing under DB-SS-04150 was completed successfully following replacement during power ascension. ARTS Channel 2 was tested and found to be functioning as required.

Scheduled Actions:

During the DBNPS refueling outage scheduled for Spring of 2020, the following actions are scheduled for completion: MSV 1 FASV, MSV 2 FASV, and MSV FASV 3 will be replaced; the EHC reservoir will be cleaned, inspected, and refilled with new fluid; the two (2) EHC pump suction strainers will be cleaned and inspected; the Jet-Tube strainers for the Main Turbine Control Valves will be replaced; and the Servo-Valves for MSV 2 and Combined Intermediate Valves 1 and 2 will be replaced.

PREVIOUS SIMILAR EVENTS:

DBNPS Licensee Event Report (LER) 2016-009, dated 11/9/16, reported a reactor trip event due to rainwater intrusion into the Main Generator Automatic Voltage Regulator (AVR) cabinet due to an open roof vent caused a lockout of the Main Generator, resulting in a trip of the Main Turbine and Reactor. Following the Reactor trip, the Steam Feedwater Rupture Control System (SFRCS) actuated due to high Steam Generator 1 level and initiated the Auxiliary Feedwater System. The most likely cause of the SFRCS actuation was a failed operational amplifier in the Integrated Control System (ICS), causing the ICS to not reduce Feedwater flow to Steam Generator 1 following the Reactor trip. The cause and action taken in response to the 2016 reactor trip event are unrelated to the cause of the event being reported in this LER and there have been no LERs at the DBNPS involving a similar reactor trip in the past three (3) years.